

## ABSTRACT

The present invention is directed to a proteorhodopsin mutant having improved optical characteristics. One improved optical characteristic is having a lower pH ( $pK_{rh}$ ) at which equal concentrations of the acidic and basic spectral form of the proteorhodopsin molecules are present. Another improved optical characteristic is having a smaller difference in maximum absorption wavelength between the basic and the acidic form. The mutant comprises a mutation in a conserved amino acid residue of a proteorhodopsin variant, which causes spectral shifts. A preferred mutation site is a conserved histidine residue at amino acid position 75 of Bac31A8, or position 77 of Hot75m1, or its equivalent position of a proteorhodopsin variant. Another preferred mutation site is a conserved arginine residue at amino acid position 94 of Bac31A8, or position 96 of Hot75m1, or its equivalent position of a proteorhodopsin variant.

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